TITLE OF INVENTION

A SOLID-FUEL BURNING FURNACE HAVING A BURN CONTROL STACK

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] Not Applicable

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] Not Applicable

BACKGROUND OF THE INVENTION

1. Field of Invention

[0003] This invention pertains to wood burning furnaces. More particularly, it relates to a more efficient stack for exhausting combustion gases from a wood burning furnace, particularly, a wood burning boiler.

2. Description of the Related Art

[0004] Wood burning furnaces are well known in the art of heating. In a typical wood burning furnace, a combustion chamber is provided for receiving and combusting wood, often in the form of split logs. Exhaust gases are vented through a flue to the chimney. Air flow into the combustion chamber is controlled so as to control the rate at which the wood fuel burns. It is known in the art, to use such a wood burning furnace as a boiler for the production of hot water and/or steam. And, it is known in the art to use exterior wood burning boilers as an auxiliary heating source. A state-of-the-art wood burning boiler includes a water jacket surrounding the combustion chamber. This water jacket may include water-filled conduits which are routed through the combustion chamber or a faceted interface between the water jacket and the combustion chamber for increasing the surface area of the interface, and, typically, a mechanism for controlling air flow into the combustion chamber responsive to water temperature.

[0005] It is known in the art to use baffles, as seen in Figure 1 or as taught in U.S. Patent No. 4,401,101, issued on August 30, 1983, to Lunde, to control the flow of exhaust gases within the combustion chamber in order to increase the efficiency of the furnace. What is missing in the art is a high efficiency stack that can be readily retrofitted to certain existing wood burning boilers or which can be an integral part of a newly constructed wood burning boilers.

BRIEF SUMMARY OF THE INVENTION

[0006] According to one embodiment of the present invention, a stack for venting exhaust gases from the combustion chamber of a solid fuel burning apparatus, such as a boiler, to a flue is provided. The stack can be incorporated into a furnace at the time of manufacture or it can be retrofitted to certain wood burning furnaces or boilers includes an elongated tubular member having a first end, a second end and at least one inlet proximate the first end. It will be appreciated by those skilled in the art, that the elongated tubular member can have circular cross-section or a rectangular cross-section. As used herein, the term rectangular cross-section is used to denote a cross-section in which adjacent sides are of either equal or unequal length. The second end of the elongated tubular member defines an outlet which is adapted to register with a flue so as to vent combustion, or exhaust, gases from the combustion chamber to the atmosphere.

[0007] In order to create a tortuous airflow path from the combustion chamber into the stack, the stack includes at least one conduit member which is in fluid communication with the first tubular member. The conduit member includes an open end adapted to be in fluid communication with the combustion chamber for receiving combustion gases and an oppositely disposed closed end which is proximate the inlet of the elongated tubular member and is in fluid communication with the inlet of the elongated member in order to allow passage of the combustion gases through the inlet into the elongated tubular member. The conduit member thus defines a channel for communicating exhaust gases from the combustion chamber via the open end of the conduit member to the inlet of the elongated member thereby creating a tortuous airflow path from the open end of the conduit member to the outlet and the flue.

[0008] Whereas the stack of the present invention can be retrofitted to certain existing wood burning furnaces or wood burning boilers, the stack can also be a component of a newly constructed wood burning furnace or boiler. In one embodiment, the conduit member is secured to, and carried by, the elongated member. In an alternate embodiment, the conduit member is secured to the end wall of the wood burning furnace. In this embodiment, the first end of the elongated member is received in the space between the conduit member and the end wall of the wood burning furnace. In yet another embodiment, the elongated member and the conduit member are coaxial. Also, while the stack of the present invention is discussed in the context of a wood burning furnace, it will be appreciated by those skilled in the art that the stack of the present invention could be utilized in any solid fuel furnace where it is desirable to control the flow of air through the combustion chamber.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0009] The above-mentioned features of the invention will become more clearly understood from the following detailed description of the invention read together with the drawings in which:

Figure 1 is a cross-sectional view of a prior art wood burning boiler;

Figure 2 is a perspective view of one embodiment of the stack of the present invention;

Figure 3 is a front elevation view of the stack illustrated in Figure 2;

Figure 4 is a top plan view of the stack illustrated in Figure 2;

Figure 5 is a side elevation view of the stack illustrated in Figure 2;

Figure 6 is a partial front elevation view in cross-section showing the stack of the present invention as used in conjunction with a wood burning boiler;

Figure 7 is a side elevation diagrammatic view, in partial cross-section, of a wood burning boiler incorporating the stack of the present invention;

Figure 8 is a front elevation diagrammatic view, in partial cross-section taken along line 7—7 seen in Figure 7 of a wood burning boiler incorporating the stack of the present invention;

Figures 9a and 9b are top plan views, in cross-section, of alternate embodiment stacks; and

Figures 10a and 10b are top plan views, in cross-section, of other alternate embodiment stacks in which the elongated tubular member and the conduit member are coaxial.

DETAILED DESCRIPTION OF THE INVENTION

[0010] Wood burning furnaces have long been used for the production of heat and in the form of a boiler for producing heated water or steam. The heated water or steam can then be used as an auxiliary heat source. A state-of-the-art wood burning boiler is designated as **10** in Figure 1. The state-of-the-art wood burning boiler **10** includes a firebox **12'** that defines a combustion chamber **14'**. A door **16** is provided in one end of the firebox **12** for providing access to the firebox **12'** and for loading wood into the combustion chamber **14'**. The flow of air into the combustion chamber **14'** is controlled by a vent **18'**, shown schematically in Figure 1, which can include a mechanism for controlling the vent **18'** which is responsive to water temperature. The firebox **12'**, which can either be rectangular or circular in cross-section, is surrounded by a fluid-filled jacket, which typically contains water, which acts as a heat exchanger. In this regard, the fire in the combustion chamber **14'** heats the water in the water jacket **20'** to the desired temperature and this heated water is circulated through a system (not shown) for providing auxiliary heat to a number of different types of applications. A flue **22'** is typically provided as a passageway for exhaust gases from the combustion chamber 14 to the chimney **24'**. In this regard, the flue **22'** can be vertical, extend through the top of the firebox **12'** and be integral with the chimney or can be horizontal, extend through an end wall of the firebox **12'** and adjoin the chimney. In order to restrict the flow of exhaust gases through the flue **22'** and thereby allow for a slower burn and greater heat transfer from the fire and combustion gases to the water in the

water jacket **20'**, a baffle, such as baffle **26** is frequently placed in the combustion chamber **14'** for redirecting, or controlling, the flow path of the combustion gases.

[0011] According to one embodiment of the present invention, as best illustrated by Figures 2 and 6, a stack **100** is provided for venting exhaust gases from a combustion chamber **14** of a wood burning apparatus, such as a boiler **90**, to a flue. While the present invention is discussed with regard to a wood burning furnace or boiler, it will be appreciated that the present invention could be utilized in conjunction with any solid fuel burning furnace. The stack **100**, which can be retrofitted to certain wood burning furnaces or boilers, includes an elongated tubular member **105**. It will be appreciated by those skilled in the art, that the elongated tubular member **105** can have circular cross-section or a rectangular cross-section. As stated above, the term rectangular cross-section is used to denote a cross-section in which adjacent sides are of either equal or unequal length. Tubular member **105** has a first end **110**, a second end **115** and at least one inlet **112** proximate the first end **110**. The second end **115** of the elongated tubular member **105** defines an outlet **116** which is adapted to register with a flue **22** so as to vent combustion, or exhaust, gases from the combustion chamber **14** to the atmosphere through the chimney **24**. In order to allow residue to be more easily cleaned from the first end of the elongated tubular member, a closeable door **118** can be provided in the first end **110** of the elongated tubular member **105**.

[0012] Further, the stack **100** includes at least one conduit member **120** which is in fluid communication with the first tubular member **105**. In this regard, the conduit member(s) **120** includes an open end **122** adapted to be in fluid communication with the combustion chamber **14** for receiving combustion gases and an oppositely disposed closed end **126** which is proximate the inlet **112** of the elongated tubular member **105** and is in fluid communication with the inlet **112** of the elongated tubular member **105** in order to allow passage of the combustion gases through the inlet **112** into the elongated tubular member **105**. The conduit member **120** thus defines a channel for communicating exhaust gases from the combustion chamber **14** via the open end **122** of the conduit member **120** to the inlet **112** of the elongated tubular member **105** thereby creating a tortuous airflow path, depicted by the arrows in Figure 6, from the open end **122** of the conduit

member **120** to the outlet **116** defined by the second end **115** of the elongated tubular member **105** and the flue **22**. In the depicted embodiment, the interaction of the elongated tubular member **105** and the conduit member **120** causes the airflow path of the combustion gases to substantially reverse direction, thereby creating a tortuous airflow path as shown in Fig. 6.

[0013] Whereas the stack of the present invention can be retrofitted to certain existing wood burning furnaces or wood burning boilers, the stack can also be a component of a newly constructed wood burning furnace or boiler **90** having a firebox **12** having an opening such as a door **16** in at least one end for receiving a solid fuel, such as wood **28** and having a main body portion defining a combustion chamber **14** with a firebox end wall **30** opposite the open end. A vent member **32** is provided for allowing combustion air to flow into the combustion chamber **14**. A control mechanism, illustrated schematically at **34**, can be provided and in active engagement with the vent member **32** for selectively regulating the flow of combustion air into the combustion chamber **14**. It will be recognized by those skilled in the art that while a vent member **32** is illustrated diagrammatically as being associated with the door **16**, other ways of permitting or injecting combustion air into the combustion chamber **14** may be utilized as desired.

[0014] In the embodiment discussed above and illustrated in Figures 2-6, the conduit member **120** is secured to, and carried by, the elongated tubular member **105**. In an alternate embodiment, illustrated in Figs. 7-9, a stack **100'** is provided in which the conduit member **120'** is secured to the end wall of the wood burning furnace or boiler **90**. In this embodiment, the first end **110'** of the elongated tubular member **105** is received in the space **128** between the conduit member **120'** and the end wall **30** of the wood burning furnace or boiler **90**. The inlet described above is defined by the open first end **110'** of the elongated tubular member **105**. As best illustrated in Figure 8, this embodiment also provides for a tortuous airflow path, as seen by the arrows, for the exhaust gases from the combustion chamber **14** to the chimney **24**. It will also be appreciated that in yet another embodiment, illustrated in Figs. 10-11, a stack **100"** is provided in which the elongated tubular member **105** and the conduit member **120"** are coaxial. As alluded to above, and as illustrated in Fig. 11, elongated tubular member **105'** and

conduit member **120'"** can have a circular cross-section. Also, while the stack **100** of the present invention is discussed in the context of a wood burning furnace, it will be appreciated by those skilled in the art that the stack of the present invention could be utilized in any solid fuel furnace where it is desirable to control the flow of air through the combustion chamber. While various spatial relationships between the elongated tubular member **105** and the conduit **120** have been discussed and illustrated, it will be appreciated by those skilled in the art that there may be other spatial arrangements that nevertheless create a tortuous airflow path as discussed above. It will also be appreciated by those skilled in the art, that where more than one conduit members **120** is provided, or where all or a portion of the conduit member **120** surrounds the first end **110** of the elongated tubular member **105** as illustrated in Figs. 9 and 10, the channels between the sides of the elongated tubular member **105** and the conduit(s) should be symmetrical in order to allow for uniform burning of the wood **28** within the combustion chamber **14**.

[0015] From the foregoing description, it will be recognized by those skilled in the art that a stack for a wood burning furnace or boiler, which can be retrofitted to certain existing furnaces, or can be a component of a newly constructed furnace, or boiler, has been provided. The elongated tubular member **105** and the conduit member **110** co-act to create a substantially vertical tortuous airflow path for the combustion, or exhaust, gases from the combustion chamber **14** to the chimney **24**. By creating a tortuous airflow path for the combustion, or exhaust, gases to follow from the combustion chamber **14** to the chimney **24** greater efficiencies are realized in terms of increased burn times, more efficient heat transfer from the combustion chamber to the water jacket and more efficient burning of the fuel resulting in less particulate matter in the exhaust gases and less ash.

[0016] While the present invention has been illustrated by description of several embodiments and while the illustrative embodiments have been described in considerable detail, it is not the intention of the applicant to restrict or in any way limit the scope of the appended claims to such detail. Additional advantages and modifications will readily appear to those skilled in the art. The invention in

its broader aspects is therefore not limited to the specific details, representative apparatus and methods, and illustrative examples shown and described. Accordingly, departures may be made from such details without departing from the spirit or scope of applicant's general inventive concept.